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NATIONAL DAM SAFETY PROGRAM. SCOTTY'S LAKE DAM (MO 10271), MISS--ETC(U)
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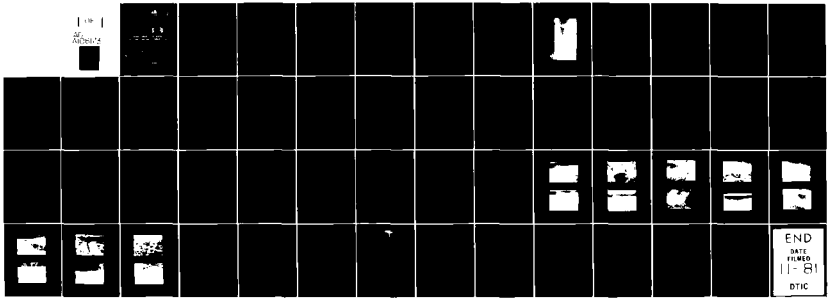

LEVEL II

(1)

MISSOURI-NEMAHA-NODAWAY BASIN

SCOTTY'S LAKE DAM

BUCHANAN COUNTY, MISSOURI

MO 10271

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

MARCH 1979

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Scotty's Lake Dam (MO 10271) Buchanan County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report. / 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Black & Veatch, Consulting Engineers	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0040
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Murray B. /Blume
Paul B. /MacRoberts
Harry L. /Callahan

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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SCOTTY'S LAKE DAM

BUCHANAN COUNTY, MISSOURI

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FOR: STATE OF MISSOURI

MARCH 1979

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Scotty's Lake Dam Inspection Report

This report presents the results of field inspection and evaluation of the Scotty's Lake Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division

27 AUG 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

27 AUG 1979
Date

SCOTTY'S LAKE DAM

BUCHANAN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10271

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

BLACK & VEATCH
CONSULTING ENGINEERS
KANSAS CITY, MISSOURI

UNDER DIRECTION OF

ST. LOUIS DISTRICT CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

MARCH 1979

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam	Scotty's Lake Dam
State Located	Missouri
County Located	Buchanan County
Stream	Tributary to Missouri River
Date of Inspection	27 March 1979

Scotty's Lake Dam was inspected by a team of engineers from Black & Veatch, Consulting Engineers for the St. Louis District, Corps of Engineers. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers and developed with the help of several Federal and state agencies, professional engineering organizations, and private engineers. Based on these guidelines, this dam is classified as a small size dam with a high downstream hazard potential. According to the St. Louis District, Corps of Engineers, failure would threaten the life and property of approximately five families within the estimated damage zone which extends 2 miles downstream of the dam.

Our inspection and evaluation indicates the spillway does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The emergency spillway will pass neither the probable maximum flood nor 50 percent of the probable maximum flood without overtopping but will pass 10 percent of the probable maximum flood, which is less than the estimated 100-year flood. The dam will pass a 10-year event without being overtopped. The spillway design flood recommended by the guidelines is 50 to 100 percent of the probable maximum flood. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Deficiencies visually observed by the inspection team were erosion and sloughing of the upstream embankment, erosion and sloughing of the downstream embankment, seepage, and the presence of excessive trees on the downstream embankment slope. The presence of brush in a localized area of the upstream embankment was also observed. Seepage and stability analyses required by the guidelines were not available.

There were no observed deficiencies or conditions existing at the time of the inspection which indicated an immediate safety hazard. Future corrective action and regular maintenance will be required to correct or control the described deficiencies. In addition, detailed seepage and stability analyses of the existing dam, as required by the guidelines, should be performed. A detailed report discussing each of these deficiencies is attached.

Murray B. Blume
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Missouri E-13742

Paul B. MacRoberts, P.E.
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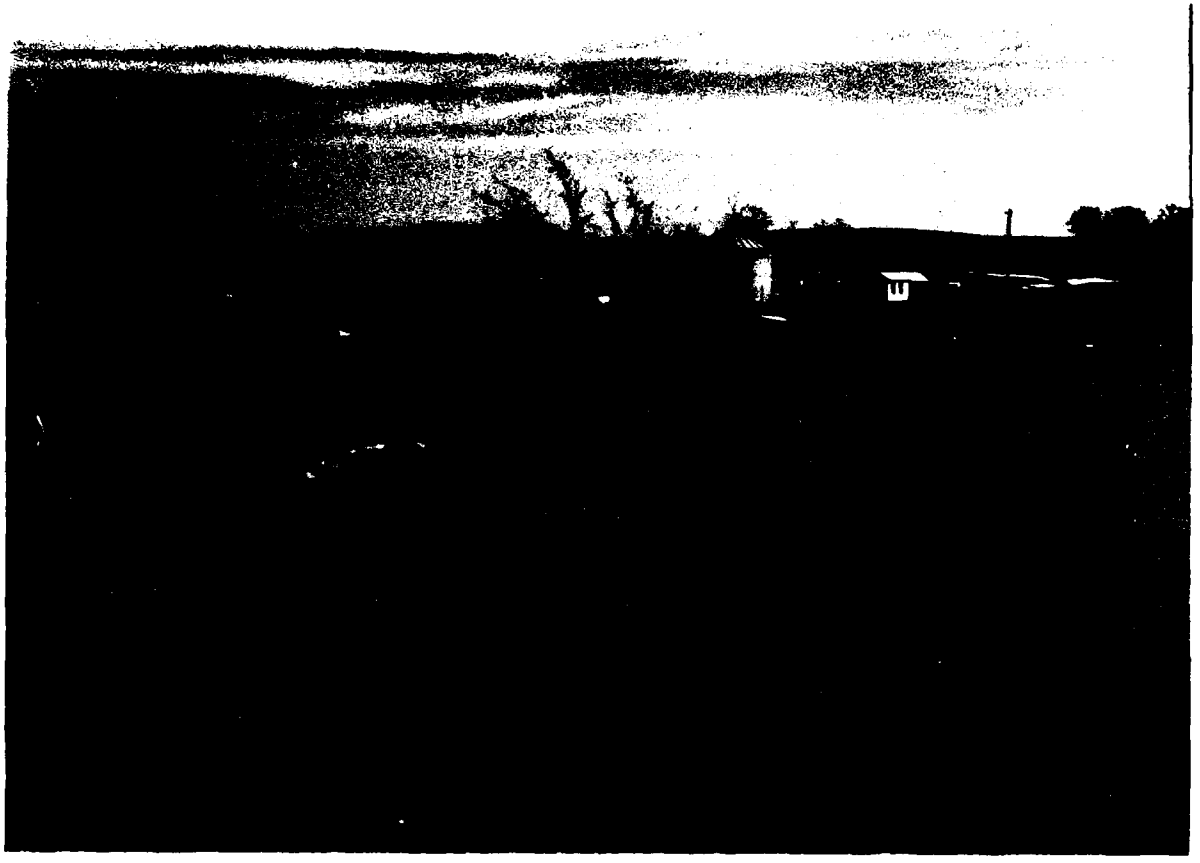
Harry L. Callahan
Harry L. Callahan, Partner
Black & Veatch



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
SCOTTY'S LAKE DAM

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APPENDIX

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the District Engineer of the St. Louis District, Corps of Engineers, directed that a safety inspection of the Scotty's Lake Dam be made.

b. Purpose of Inspection. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

c. Evaluation Criteria. Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances.

(1) The dam is an earth structure located in the shallow valley of a tributary to the Missouri River in southern Buchanan County. The dam is approximately 25 feet in height and 340 feet in length. There is a 12-inch CMP conduit located near the left abutment which serves as a principal spillway. The outlet of this conduit is at elevation 1,032.6 msl and discharges onto the toe of the dam. Located immediately to the left and downstream is a small earth dam, 257 feet in length, without spillway facilities. The emergency spillway for the main dam, Scotty's Lake, is connected to this holding pond, thus precluding any benefit when the water in the pond is at spillway elevation. For purposes of this study the holding pond was considered to be an integral part of Scotty's Lake.

The Scotty's Lake Dam embankment is relatively well protected from sheet erosion by grass, although there appears to be little if any protection on the upstream face.

(2) An earthen channel was constructed near the left abutment which empties into a relatively small holding pond having no visible outlet works or spillway.

(3) A 12-inch CMP conduit with a flared concrete entrance, fish guard, and trash rack was constructed near the left abutment and serves as the principal spillway. The outlet for this conduit exits the embankment fill and discharges onto the toe of the dam.

(4) Pertinent physical data are given in paragraph 1.3.

b. Location. The dam is located in southern Buchanan County, Missouri, as indicated on Plate 1. The lake formed by the dam is shown on the United States Geological Survey 7.5 minute series quadrangle map for Halls Missouri-Kansas in Section 26 of T56N, R36W.

c. Size Classification. Criteria for determining the size classification of dams and impoundments are presented in the guidelines referenced in paragraph 1.1c above. Based on these criteria, the dam and impoundment are in the small size category.

d. Hazard Classification. The hazard classification assigned by the Corps of Engineers for this dam is as follows: The Scotty's Lake Dam has a high hazard potential, meaning that the dam is located where failure may cause loss of life, and serious damage to homes, agricultural, industrial and commercial facilities, and to important public utilities, main highways, or railroads. For the Scotty's Lake Dam the flood damage zone extends downstream for 2.0 miles. Within the damage zone are approximately five homes.

e. Ownership. The dam is owned by Mr. Albert Scott Hall, DeKalb, Missouri 64440.

f. Purpose of Dam. The dam forms a 5.5-acre recreational and stock watering lake.

g. Design and Construction History. Data relating to the design and construction were not available.

h. Normal Operating Procedure. Normal rainfall, runoff, transpiration, and evaporation all combine to maintain a relatively stable water surface elevation. There are no known operation criteria for this structure.

1.3 PERTINENT DATA

a. Drainage Area - 95 acres

b. Discharge at Damsite.

(1) Normal discharge at the damsite is through an uncontrolled 12-inch diameter CMP conduit.

(2) Estimated experienced maximum flood at damsite - Unknown.

c. Elevation (Feet Above M.S.L.).

(1) Top of dam - 1,062.4 ± (see Plate 3)

(2) Spillway crest - 1,059.9

(3) Streambed at toe of dam - 1,038.7±

(4) Maximum tailwater - Unknown.

d. Reservoir.

(1) Length of maximum pool - 600 feet ±

(2) Length of normal pool - 550 feet ±

e. Storage (Acre-feet).

(1) Top of dam - 48

(2) Spillway crest - 40 (from 1974 inventory)

(3) Design surcharge - Not available.

f. Reservoir Surface (Acres).

(1) Top of dam - 8

(2) Spillway crest - 5.5

g. Dam.

(1) Type - Earth embankment

(2) Length - 340 feet (combined length of main lake and holding pond is 597 feet)

(3) Height - 25 feet ±

(4) Top width - 13 feet

(5) Side slopes - upstream face averages 1.0 V on 2.75 H, downstream face varies from 1.0 V on 2.7 H to 1.0 V on 1.6 H (see Plate 4)

(6) Zoning - Unknown.

(7) Impervious core - Unknown.

(8) Cutoff - Unknown.

(9) Grout curtain - Unknown.

h. Diversion and Regulating Tunnel - None.

i. Emergency Spillway.

(1) Type - Earthen channel to holding pond.

(2) Width of channel - 35 feet (Bottom), 875 feet (Top).

(3) Crest elevation - 1,059.9 feet m.s.l.

(4) Gates - None.

(5) Upstream channel - Not applicable.

(6) Downstream channel - None, holding pond.

j. Principal Spillway.

(1) Type - 12-inch CMP.

(2) Crest elevation - 1,059.4 feet m.s.l.

(3) Gates - None, uncontrolled.

(4) Upstream channel - Not applicable

(5) Downstream channel - Open channel from the discharge point at the toe of the downstream embankment slope, through a small discharge pond with a partially breached earth embankment. Channel downstream of the breach moderately eroded, with some sloughing of the near vertical banks; large tree trunks laid in channel at breach partially obstruct water flow.

k. Regulating Outlets - See item j above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

Design data were unavailable.

2.2 CONSTRUCTION

Construction records were unavailable, however the owner confirmed that the dam was built in 1959.

2.3 OPERATION

The maximum recorded loading on the dam is unknown.

2.4 GEOLOGY

The watershed topography is characterized by rolling to hilly terrain, primarily farmland. Soil observed from the high area of the watershed to the outlet channel below the discharge pond is silty clay of loessial origin of the Knox series modified by weathering. It is anticipated that the entire embankment is founded on stiff modified loess.

Bedrock was observed about 100 feet west of Station 6 + 97 near the downstream left embankment. The outcrop is a 6 ± foot section of limestone of the Shawnee Group. The limestone at the outcrop is thin to medium bedded with closely spaced open vertical joints approximately normal to the dam. Clear water was flowing from joints in the lower portion of the section at an estimated rate of 3 to 5 gallons per minute. The depth to bedrock under the dam or ponds is not known.

2.5 EVALUATION

a. Availability. No engineering data could be obtained.

b. Adequacy. No engineering data were available upon which to make a detailed assessment of the design, construction, and operation. Detailed seepage and stability analyses should be performed as required by the guidelines.

c. Validity. The validity of the design, construction, and operation could not be determined due to the lack of engineering data.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of Scotty's Lake Dam was made on 27 March 1979. The inspection team included professional engineers with experience in dam design and construction, hydrology - hydraulic engineering, and structural engineering and personnel with geotechnical expertise. Specific observations are discussed below. No observations were made of the condition of the upstream face of the dam below the pool elevation at the time of the inspection.

b. Dam. The inspection team observed the following items at the dam. The upstream slope of the embankment above the water level is very steep due to erosion and sloughing. On the downstream slope, erosion has occurred near the principal spillway conduit. The downstream face is covered with a relatively heavy growth of trees. The upstream face has an isolated area covered with brush. Some of the trees were observed as to be dead. Sloughing and seepage were observed on the downstream embankment at the centerline Station 4+25. The sloughing area appears to be located in the immediate vicinity of the junction between the main dam and the holding pond starting near the crest. The seepage was located in the same general area but lower on the embankment. The downstream face had an uneven slope, possibly caused by a combination of construction methods and livestock. The backfill over the buried conduit in the downstream slope appears to be settling. A small mid-slope failure has occurred in that backfill, and the exposed face is soft and saturated. No other obvious signs of crest settlement, crest sinkholes, or embankment cracking were noted.

c. Appurtenant Structures. The inspection team observed the following items pertaining to appurtenant structures. An earthen channel spillway that was constructed near the left abutment appears in fair condition. The spillway is acting as a broad-crested weir. There is no side slope or channel protection in the spillway.

The inlet to the 12-inch CMP conduit is enclosed in a concrete structure, and is equipped with a trash rack. The rack was not in position at the time of inspection. Seepage of clear water, 2 to 3 gallons per minute, was observed near the toe of the embankment close to the bottom of the conduit.

d. Reservoir Area. No slides or excessive erosion due to wave action were observed along the shore of the reservoir.

e. Downstream Channel. Water flows through a 12-inch diameter CMP conduit to a short channel at the toe of the downstream slope of the dam, and then into a discharge pond. At the downstream end of the

discharge pond water flows to an open channel with near vertical sides in modified loess. Large tree trunks placed in the channel near the suspected breach in the discharge pond embankment partially obstructs flow from the discharge pond.

3.2 EVALUATION

The visual inspection conducted on this dam has resulted in the identification of five (5) physical conditions or deficiencies which warrant discussion.

Of most importance is the apparent lack of an emergency spillway. The original structure known as Scotty's Dam achieved a degree of protection from overtopping by the use of the earth channel at the left abutment. Since the time when the holding pond was constructed and more recently since it was raised, the protection afforded Scotty's Dam by the earth channel, emergency spillway, has been eliminated.

The effective elimination of the emergency spillway should be considered as a potential source of future problems.

Sloughing and erosion of both the upstream and downstream embankments presents no immediate potential for failure. However, if left unprotected the upstream face will continue to be eroded by wave action and the potential for failure will simultaneously increase.

Erosion at the principal spillway's point of discharge resembles a splash pool and if left unchecked can lead to possible problems such as embankment slides in the immediate vicinity. Sloughing of embankment material at the point where the main Scotty's Dam and the holding pond join is presently of more concern. Apparent seepage and possible overflow may be contributing factors to the conditions noted. Dead trees are further evidence of excessive water in the root zones. Total removal of the stand of trees located on the downstream slope is not recommended at this time. Removal can lead to future problems caused by allowing seepage/leakage through holes produced by decaying roots. Control of the trees is however recommended.

Observed seepage in proximity to the 12-inch CMP point of discharge may arise from numerous sources but could conceivably be attributed to the following:

(a) Water movement along the interface between the left abutment material and the dam.

(b) Leakage along the 12-inch CMP.

(c) Leakage from the 12-inch CMP.

(d) Leakage through channels produced by decayed roots.

(e) Seepage through pervious layers of the dam embankment.

Analyses of the observed seepage should be performed. It should necessarily be monitored and remedial measures formulated and implemented. If left in the present condition, seepage will continue to be a potential source for failure.

Uncontrolled brush growth while acting to stabilize an area of the upstream face should be controlled. Continuous growth of such brush can lead to possible problems associated with decayed roots etc.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The pool is primarily controlled by rainfall, runoff, evaporation, and capacity of the uncontrolled principal spillway (12-inch CMP).

4.2 MAINTENANCE OF DAM

Maintenance performed was unknown.

4.3 MAINTENANCE OF OPERATING FACILITIES

No operating facilities are known to exist.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection team is not aware of any existing warning system for this dam.

4.5 EVALUATION

No known operation facilities exist. No operational procedures are being implemented which warrant evaluation.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Design data pertaining to hydrology and hydraulics were unavailable.

b. Experience Data. The drainage area and lake surface area are developed from USGS Halls, Missouri-Kansas Quadrangle Map. The spillway and dam layouts are from surveys made during the inspection.

c. Visual Observations.

(1) The spillway is in fair condition. The discharge channel needs slope protection.

(2) No facilities are available that could serve to draw down the pool.

(3) An exit channel is located near the left abutment. Spillway discharges may endanger the integrity of the dam due to the fact the spillway discharge enters a non-outlet holding pond, thus increasing the potential for overtopping at lesser return interval floods.

(4) The inlet for the 12-inch CMP conduit does not have an anti-vortex device.

d. Overtopping Potential. The principal spillway will not pass the probable maximum flood without overtopping the dam. The probable maximum flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The principal spillway will pass 10 percent of the probable maximum flood without overtopping the dam but will not pass the 100-year flood. The runoff volume of 10 percent of the probable maximum flood is less than that of the 100-year flood. The principal spillway will pass the 10-year flood with a maximum reservoir elevation less than that resulting from 10 percent of the probable maximum flood. The difference in maximum reservoir elevation is attributed to the increased antecedent moisture condition and the rainfall distribution peculiar to 10 percent of the probable maximum flood. The result is a greater volume of runoff prior to the peak of the 10 percent probable maximum event than the volume of runoff prior to the peak of the 10-year event. Distributions for the 10-year and 100-year rainfalls were provided by the St. Louis District, Corps of Engineers. According to the recommended guidelines from the Department of the Army, Office of the Chief of Engineers, a high hazard dam of small size should pass 50 to 100 percent of the probable maximum flood. The portion of the estimated peak discharge of the probable maximum

flood overtopping the dam would be 1,770 cfs of the total discharge from the reservoir of 1,780 cfs. The estimated duration of overtopping is 13.7 hours with a maximum height of 1.1 feet. The portion of the estimated peak discharge of 50 percent of the probable maximum flood overtopping the dam would be 850 cfs of the total discharge of the reservoir of 860 cfs. The estimated duration of overtopping is 11.1 hours with a maximum height of 0.5 feet.

There was no visible evidence at the time of inspection that Scotty's Lake Dam has been overtopped. Additional fill material has been added to the crest of the small holding pond immediately to the left of the main dam which in effect increases the potential for overtopping of the main dam.

According to the St. Louis District, Corps of Engineers, the effect from rupture of the dam could extend approximately 2 miles downstream of the dam. There are approximately five homes which could be severely damaged and lives could be lost should failure of the dam occur.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which affect the structural stability of this dam are discussed in Section 3, paragraph 3.1b.

b. Design and Construction Data. No design data relating to the structural stability of the dam were found. Detailed seepage and stability analysis should be performed as required by the guidelines.

c. Operating Records. No operational records exist.

d. Post Construction Changes. No known post construction changes were apparent on the Scotty's Lake Dam, however, added fill has recently been placed on the crest of the adjacent holding pond.

e. Seismic Stability. The dam is located in Seismic Zone 1 which is a zone of minor seismic risk. A properly designed and constructed earth dam using sound engineering principles and conservatism should pose no serious stability problems during earthquakes in this zone.

The seismic stability of an earth dam is dependent upon a number of factors: The important factors being embankment and foundation material classification and shear strengths; abutment materials, conditions, and strength; embankment zoning; and embankment geometry. Adequate descriptions of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment were not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the stability analysis required by the guidelines.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. Several items noted during the visual inspection by the inspection team which should be monitored or controlled are sloughing and erosion of the upstream embankment slope, erosion and sloughing of the downstream slope near the outlet conduit and an uncontrolled stand of brush and trees on both the downstream and upstream embankment slopes.

b. Adequacy of Information. Due to the lack of engineering design data, the conclusions in this report were based only on performance history and visual conditions. The inspection team considers that these data are sufficient to support the conclusions herein. However, seepage and stability analyses are needed to satisfy the requirements of the guidelines.

c. Urgency. It is the opinion of the inspection team that a program should be developed as soon as possible to implement remedial measures recommended in paragraph 7.2b. If the safety deficiencies listed in paragraph 7.1a are not corrected, they will continue to deteriorate and lead to a serious potential of failure.

d. Necessity for Phase II. The Phase I investigation does not raise any serious questions relating to the safety of the dam or identify any serious dangers that would require a Phase II investigation.

e. Seismic Stability. This dam is located in Seismic Zone 1. Adequate description of embankment design parameters, foundation and abutment conditions, or static stability analyses to assess the seismic stability of this embankment was not available and therefore no inferences will be made regarding the seismic stability. An assessment of the seismic stability should be included as part of the recommended stability analysis.

7.2 REMEDIAL MEASURES

a. Alternatives. The principal spillway has the capacity to pass 10 percent of the probable maximum flood without overtopping the dam. In order to pass 50 to 100 percent of the probable maximum flood as required by the Recommended Guidelines, the spillway size and/or height of dam would need to be increased. It is the opinion of the inspection team that an emergency spillway is required to meet current design practices.

b. O&M Maintenance and Procedures. The following O&M maintenance and procedures are recommended:

(1) Check the downstream face of the dam periodically for seepage and stability problems. If seepage flows are observed to increase in volume or sloughing on the downstream embankment slope is noted, the dam should immediately be inspected and the condition evaluated by an engineer experienced in design and construction of earthen dams.

(2) Due to the density and large size of the trees on the downstream slope of the dam, and the uncontrolled brush growth on the upstream face, an engineer experienced in the maintenance and design of earthen dams should be retained to recommend procedures to control such growth and establish proper slope protection.

(3) The bottom and side slopes of the principal spillway discharge channel should be protected from erosion to prevent erosion of the dam embankment.

(4) An engineer experienced in the design and construction of earth dams should be retained to design an adequate emergency spillway for this system of dams.

(5) Erosion protection should be added on the upstream embankment slope. This protection is needed to prevent erosion of the embankment material due to wave action.

(6) Seepage and stability analysis should be performed by a professional engineer experienced in the design and construction of dams.

(7) A detailed inspection of the dam should be made at least every year by an engineer experienced in design and construction of dams. More frequent inspections may be required if additional deficiencies are observed or the severity of the reported deficiencies increases.

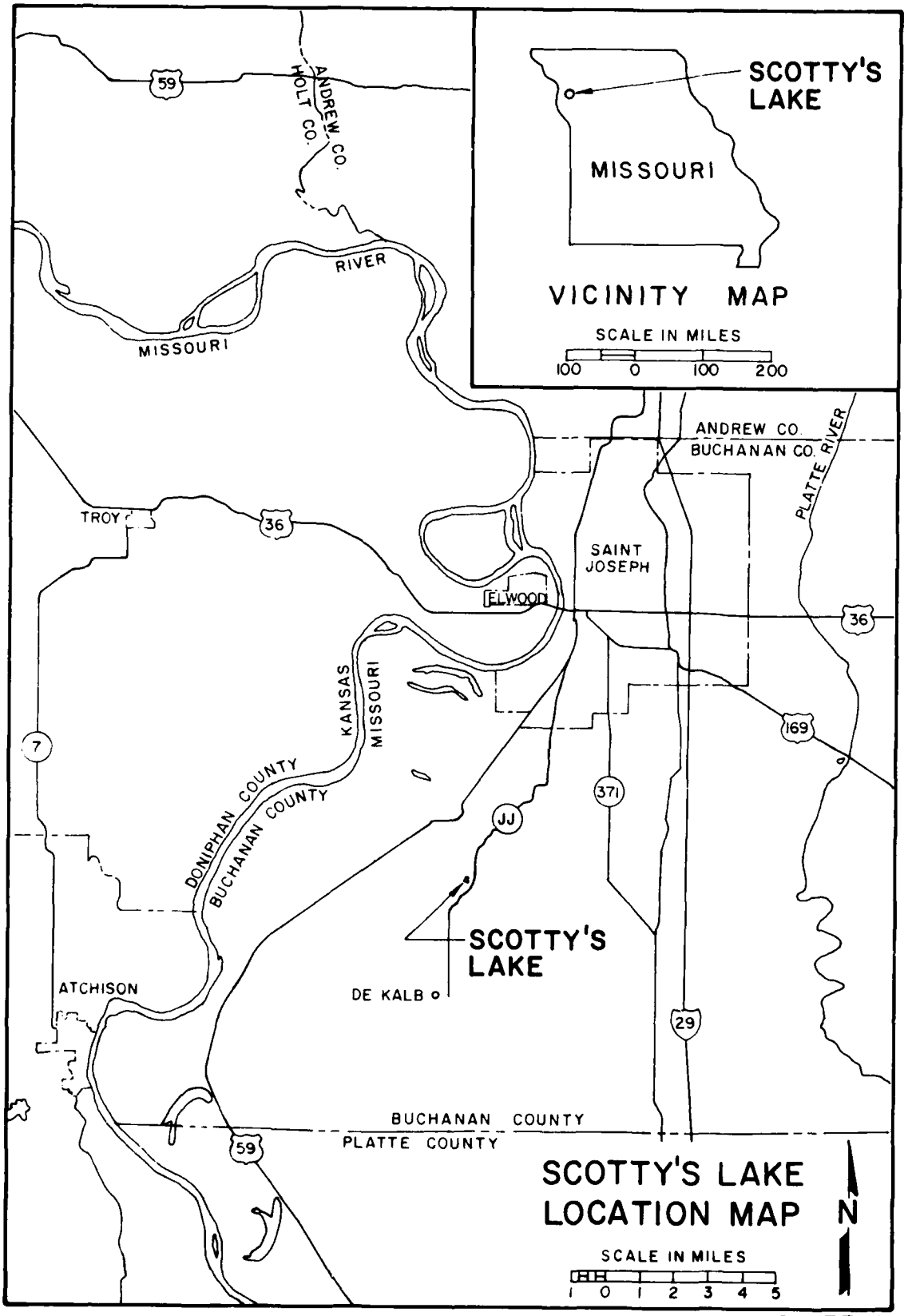
SCOTTY'S LAKE
MISSOURI
VICINITY MAP
SCALE IN MILES
100 0 100 200
59
ANDREW CO.
HOLT CO.
RIVER
MISSOURI
TROY
36
ANDREW CO.
BUCHANAN CO.
PLATTE RIVER
SAINT JOSEPH
ELWOOD
36
KANSAS
MISSOURI
7
169
DONIPHAN COUNTY
BUCHANAN COUNTY
371
JJ
SCOTTY'S LAKE
DE KALB
ATCHISON
29
BUCHANAN COUNTY
PLATTE COUNTY
59
SCOTTY'S LAKE LOCATION MAP
N
SCALE IN MILES
1 0 1 2 3 4 5

PLATE 1

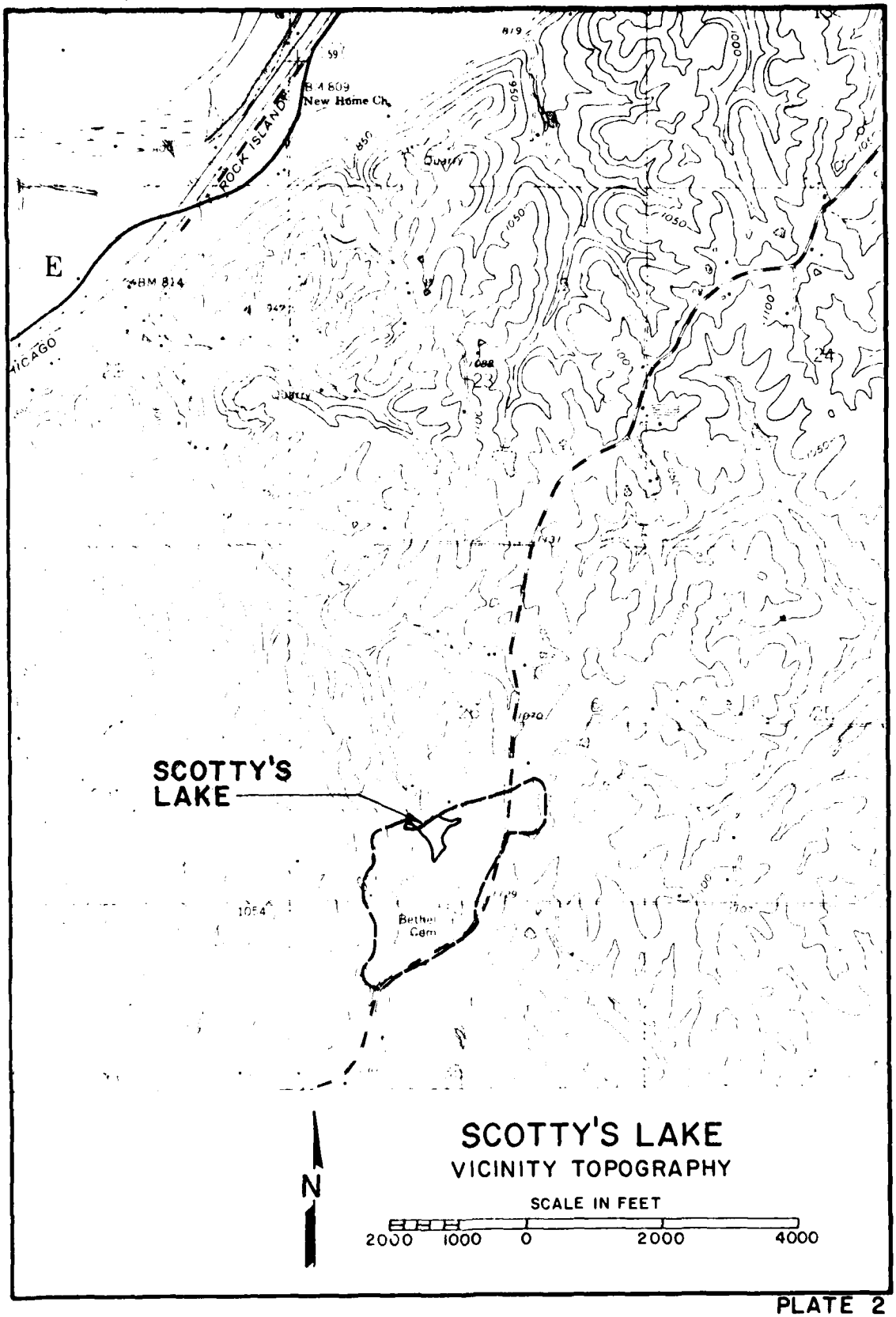
SCOTTY'S
LAKE
ROCK ISLAND
New Home Ch.
BM 814
Bethel
Cem
N
SCOTTY'S LAKE
VICINITY TOPOGRAPHY
SCALE IN FEET
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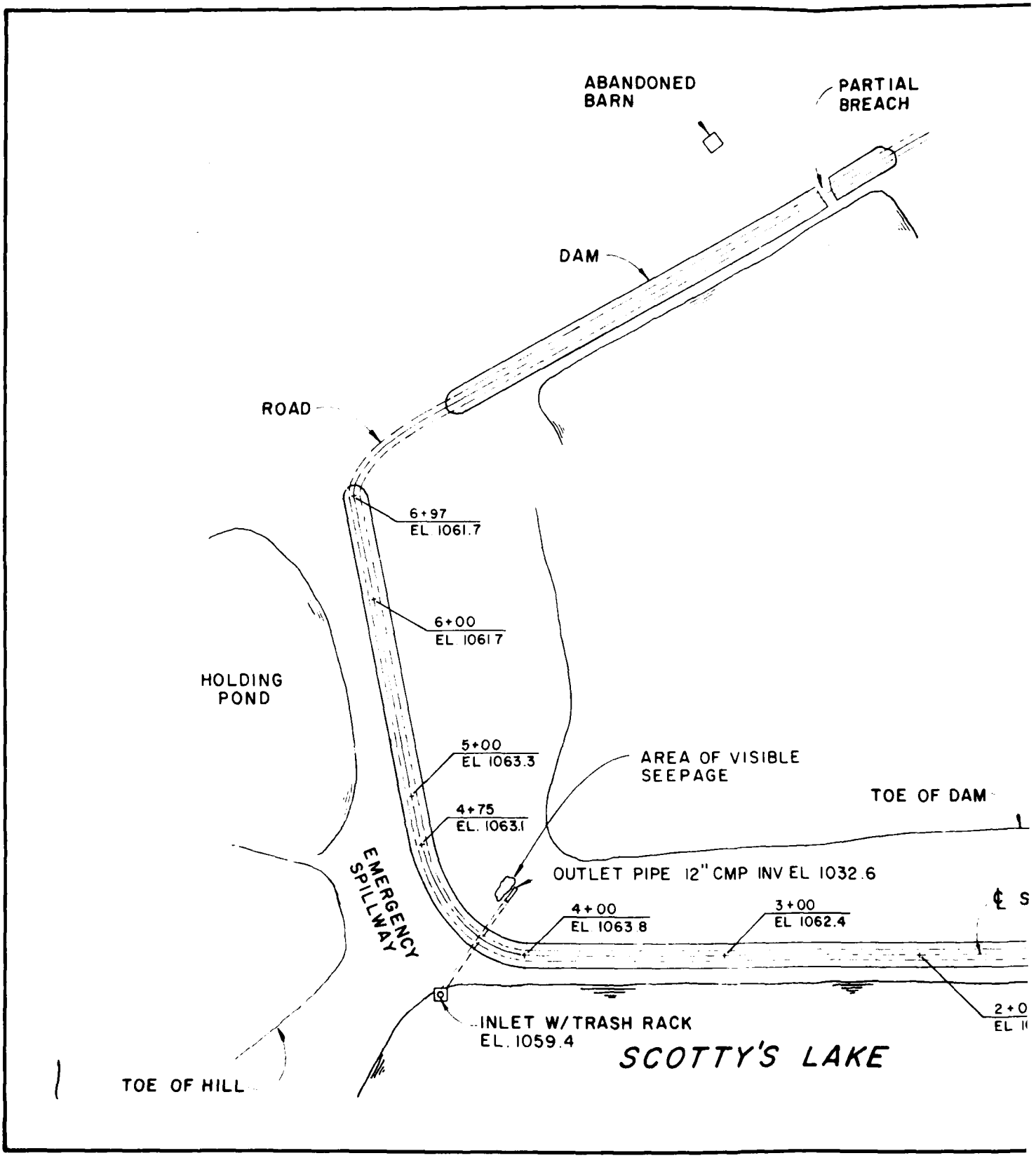
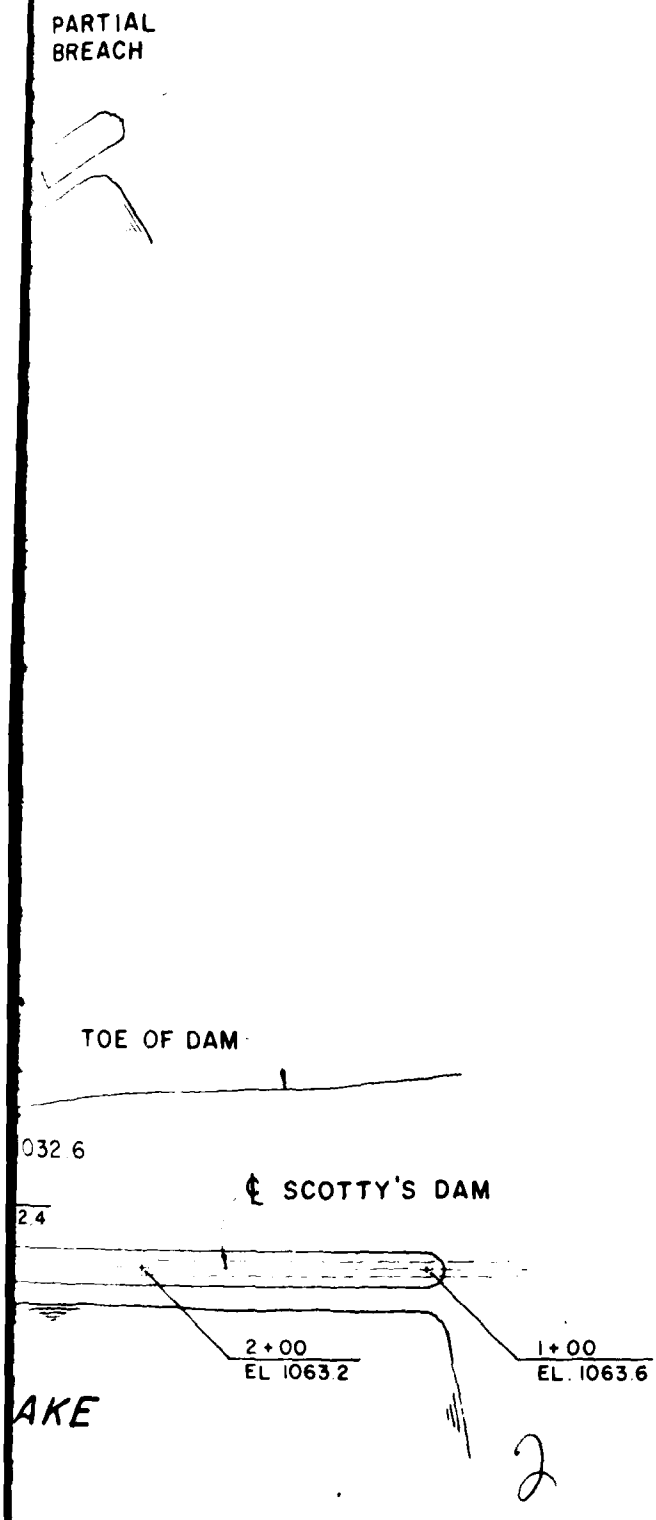
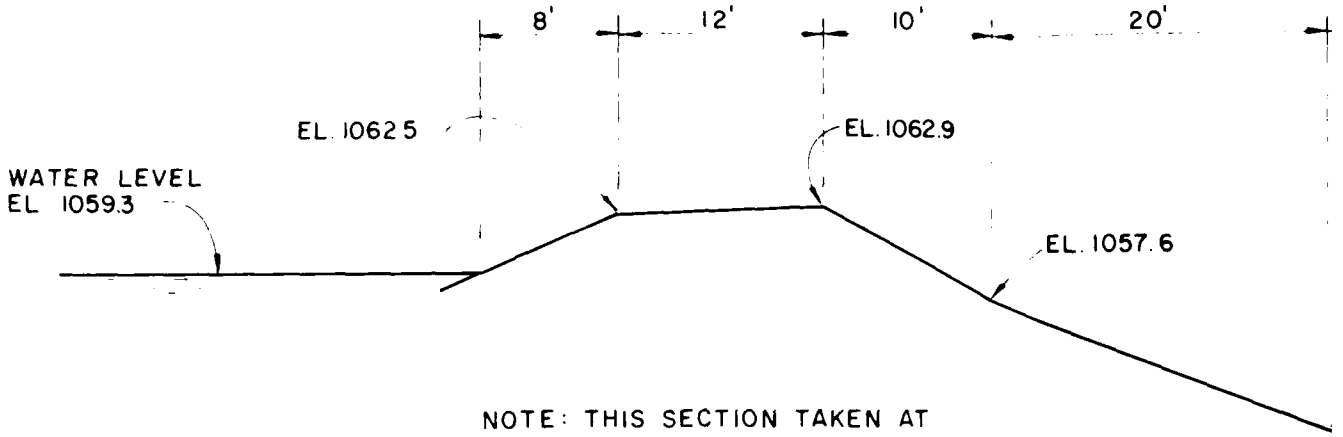
PLATE 2


ABANDONED BARN
PARTIAL BREACH
DAM
ROAD
6+97
EL 1061.7
6+00
EL 1061 7
HOLDING POND
5+00
EL 1063.3
AREA OF VISIBLE SEEPAGE
TOE OF DAM
4+75
EL. 1063.1
EMERGENCY SPILLWAY
OUTLET PIPE 12" CMP INV EL 1032.6
4+00
EL 1063 8
3+00
EL 1062.4
INLET W/TRASH RACK
EL. 1059.4
SCOTTY'S LAKE
TOE OF HILL

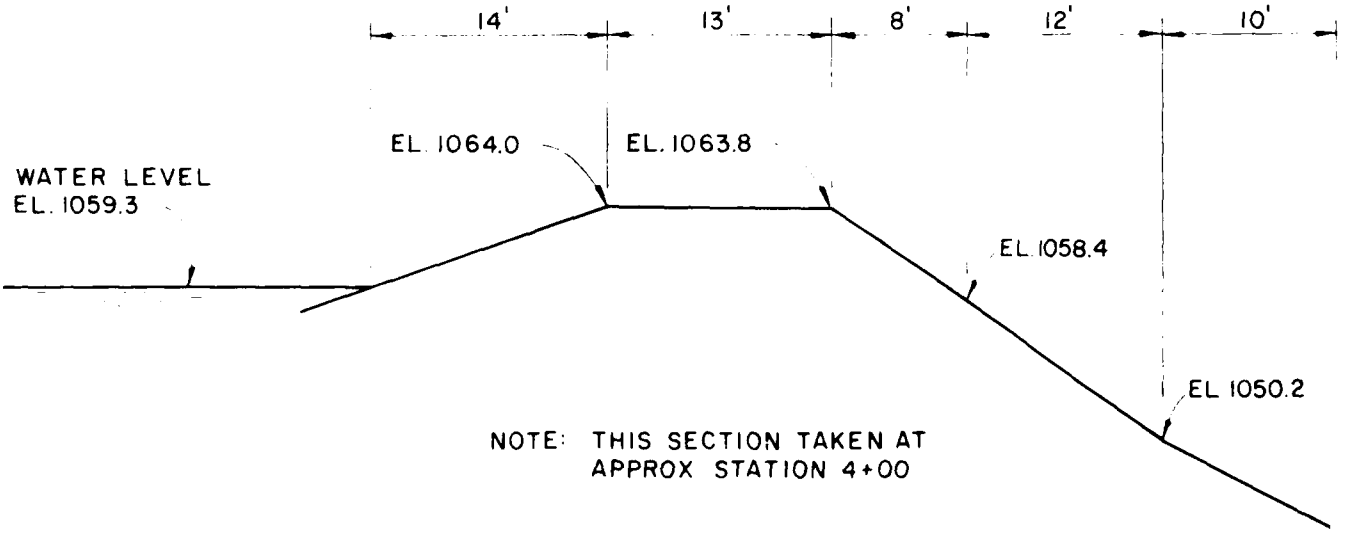


SCOTTY'S LAKE
PLAN

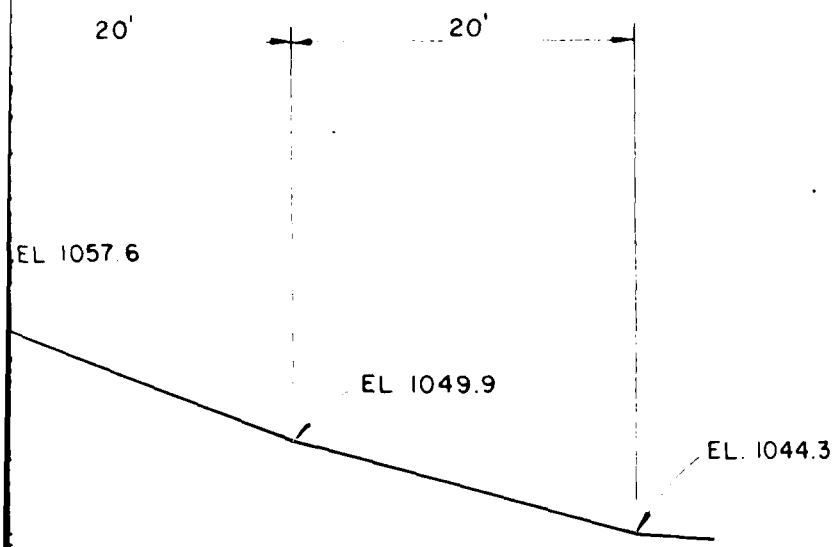
PLATE 3

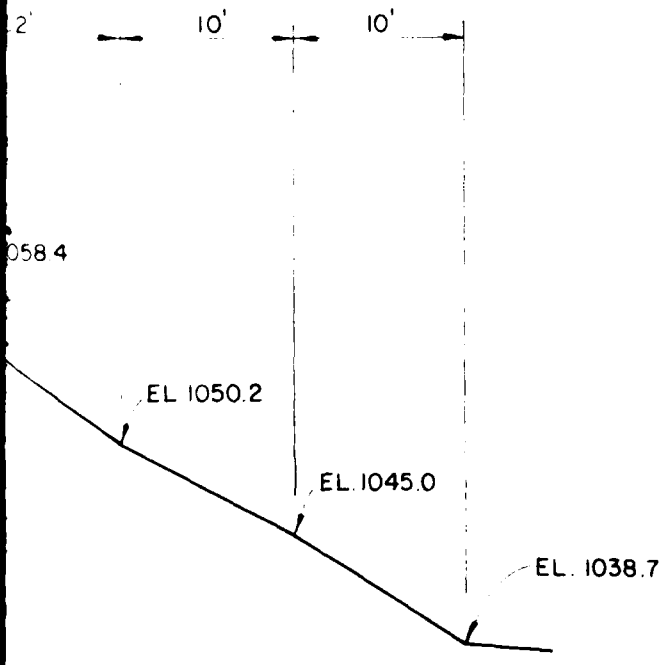


NOTE: THIS SECTION TAKEN AT
APPROX. STATION 2+60



NOTE: THIS SECTION TAKEN AT
APPROX STATION 4+00

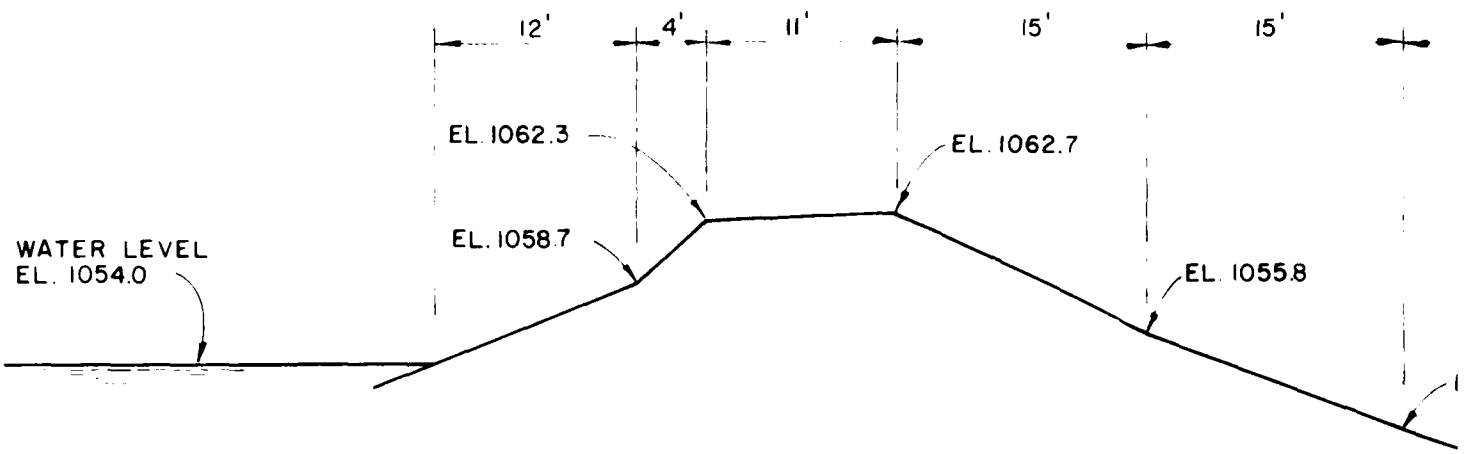




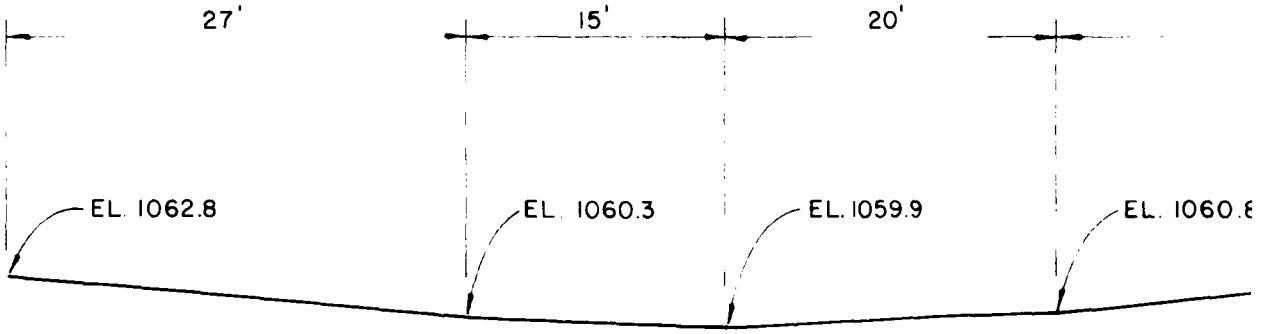
2

SCOTTY'S LAKE SECTIONS

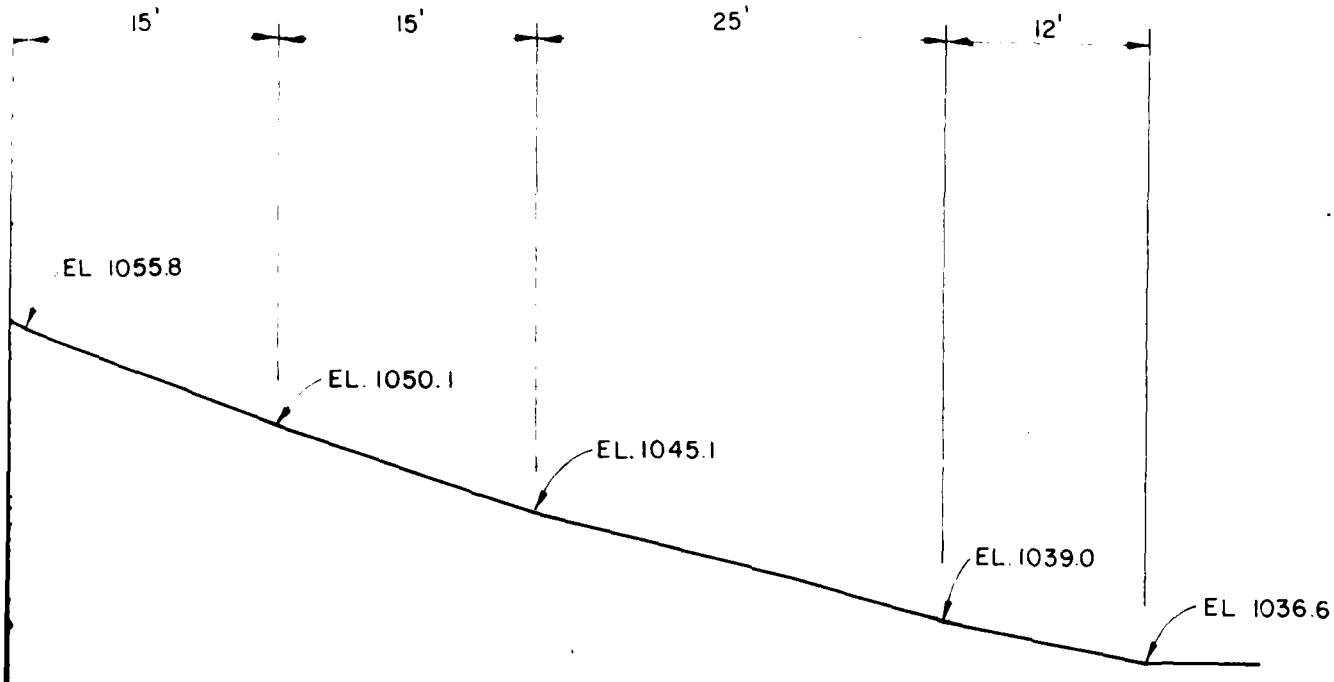
PLATE 4

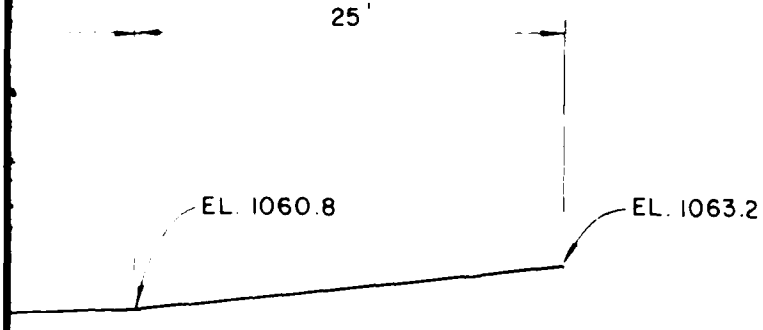


NOTE: THIS SECTION TAKEN AT
APPROX. STATION 5+30



NOTE: THIS SECTION TAKEN THROUGH
EMERGENCY SPILLWAY LOOKING
UPSTREAM AT APPROX. 4+52

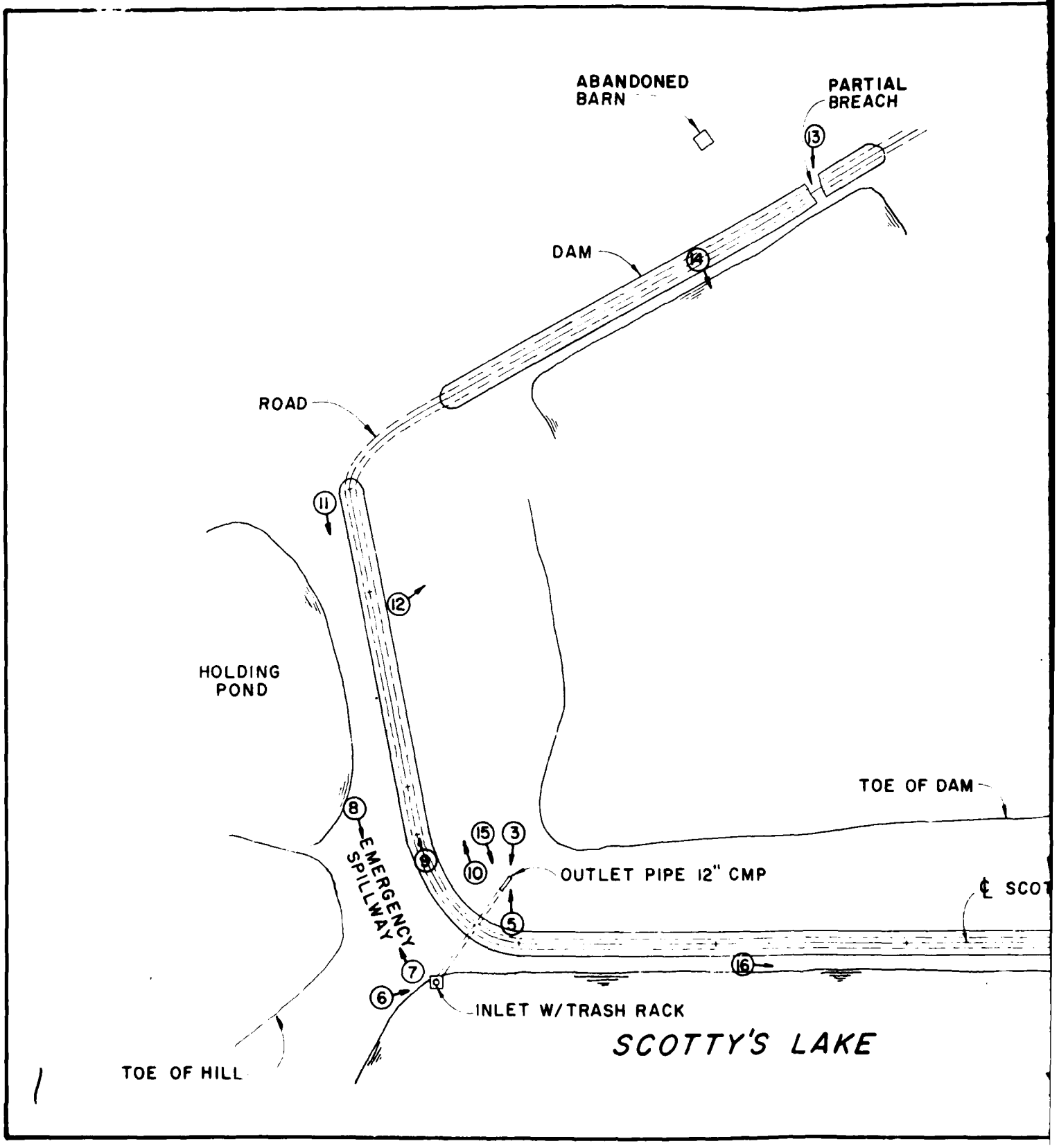




2

SCOTTY'S LAKE SECTIONS

PLATE 5


ABANDONED BARN
PARTIAL BREACH
13
DAM
14
ROAD
11
12
HOLDING POND
TOE OF DAM
8
EMERGENCY SPILLWAY
15
3
10
9
OUTLET PIPE 12" CMP
5
℄ SCOT
16
7
6
INLET W/TRASH RACK
SCOTTY'S LAKE
TOE OF HILL


PARTIAL
BREACH
LEGEND
① PHOTO LOCATION AND
DIRECTION
TOE OF DAM
℄ SCOTTY'S DAM
①
②
④
AKE
N
SCOTTY'S LAKE
PHOTO INDEX

PLATE 6

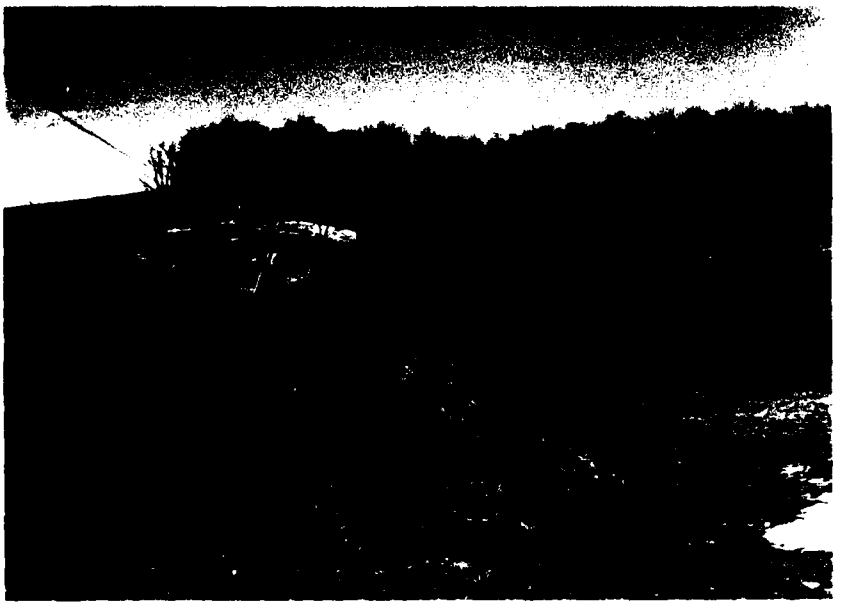


PHOTO 1: DOWNSTREAM FACE OF DAM (LOOKING WEST)

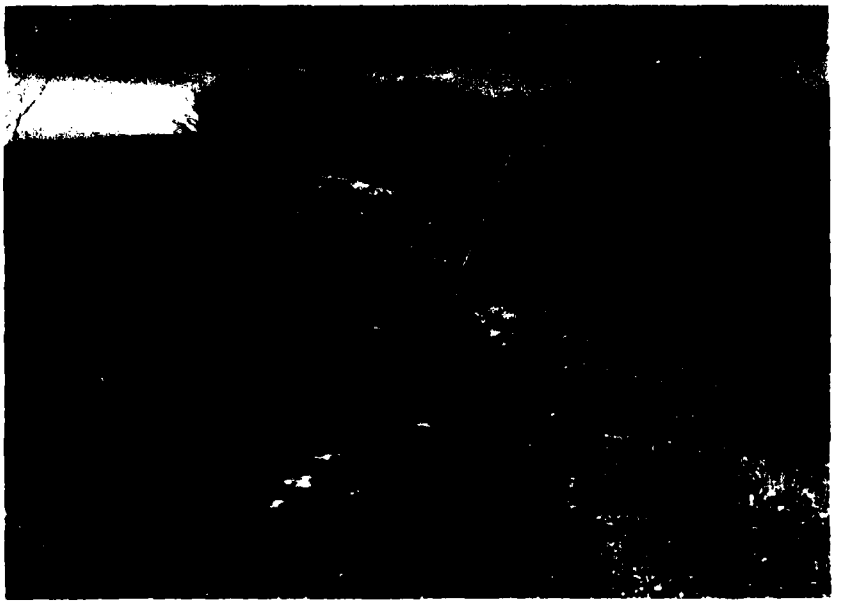


PHOTO 2: CREST OF DAM (LOOKING WEST)

PHOTO 3: OUTLET PIPE DISCHARGE

PHOTO 4: UPSTREAM FACE OF DAM (LOOKING WEST)

PHOTO 5: OUTLET PIPE DISCHARGE (LOOKING DOWNSTREAM)

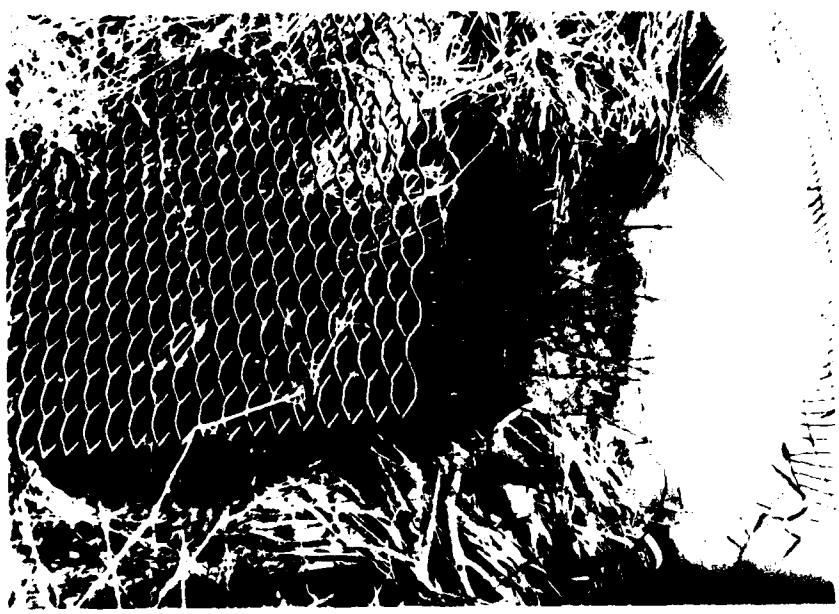


PHOTO 6: SPILLWAY DROP INLET

PHOTO 7: EMERGENCY SPILLWAY (LOOKING DOWNSTREAM)

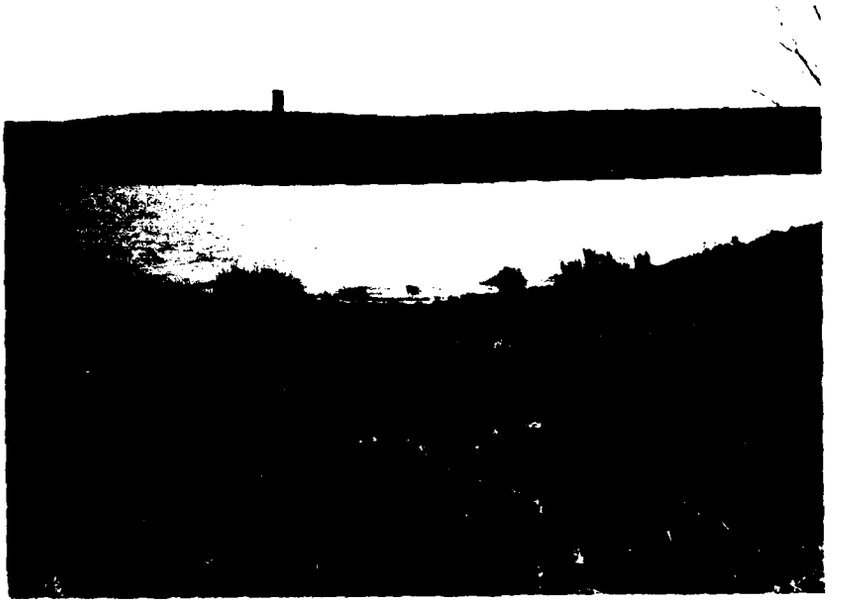


PHOTO 8: EMERGENCY SPILLWAY (LOOKING UPSTREAM)

PHOTO 9: CREST OF SIDE DAM (LOOKING NORTH)

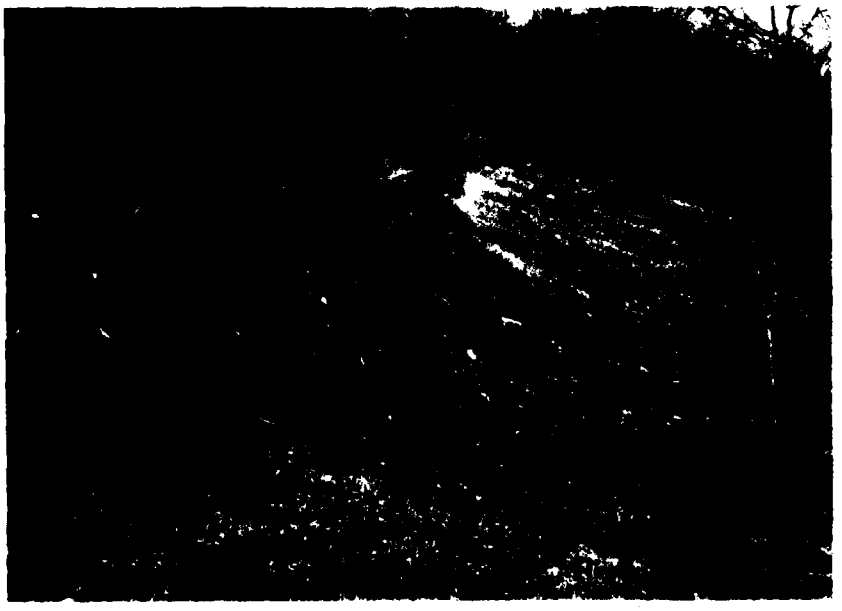


PHOTO 10: DOWNSTREAM FACE OF SIDE DAM (LOOKING NORTH)

PHOTO 11: UPSTREAM FACE OF SIDE DAM (LOOKING SOUTH)

PHOTO 12: LOWER LAKE (LOOKING EAST)

PHOTO 13: BREACH IN LOWER LAKE DAM

PHOTO 14: DOWNSTREAM FACE OF DAM (LOOKING SOUTH)

PHOTO 15: SEEPAGE NEAR OUTLET PIPE DISCHARGE

PHOTO 16: EROSION OF UPSTREAM FACE OF DAM

APPENDIX A

HYDROLOGIC COMPUTATIONS

HYDROLOGIC COMPUTATIONS

1. The Soil Conservation Service (SCS) dimensionless unit hydrograph and HEC-1 (1) were used to develop the inflow hydrographs (see Plates A-1, A-2, A-3, and A-4), and hydrologic inputs are as follows:

a. Twenty-four hour, probable maximum precipitation determined from U.S. Weather Bureau Hydrometeorological Report No. 33.

200 square mile, 24 hour rainfall inches	- 24.2
10 square mile, 6 hour percent of 24 hour 200 square mile rainfall	- 101%
10 square mile, 12 hour percent of 24 hour 200 square mile rainfall	- 120%
10 square mile, 24 hour percent of 24 hour 200 square mile, rainfall	- 130%

b. Drainage area = 91 acres.

c. Time of concentration: $Tc = (11.9 \times L^3/H)^{0.385} = 0.16$ hours = 10 minutes (L = length of longest watercourse in miles, H = elevation difference in feet) (2)

d. Losses were determined in accordance with SCS methods for determining runoff using a curve number of 91 and antecedent moisture condition III. The hydrologic soil group in the basin was B.

e. Inflows for the 100-year flood were determined from the twenty-four hour, 100-year rainfall distribution for drainage areas less than one square mile provided by the St. Louis District, Corps of Engineers. Losses for the 100-year event were determined in accordance with SCS methods for determining runoff using a curve number of 79 and antecedent moisture condition II.

2. Spillway release rates are based on three types of flow through the drop inlet: weir flow, orifice flow and pipe full flow.

Weir flow equation:

$Q = C_o\ 2\ rH^{3/2}$ (C_o = 1.0, r = 0.5 feet, H = head above pipe inlet)

Orifice flow equation:

$Q = C_D\ A\ \sqrt{2gh}$ (C_D = 0.65, A = 0.79 ft^2, g = 32.2 ft/sec^2,
h = head above pipe inlet)

Pipe full flow equation:

$Q = C_D\ A\ \sqrt{2gh}$ (C_D = 0.31, A = 0.79 ft^2, g = 32.2 ft/sec^2,
h = head above pipe outlet)

Discharge rates over the top of the dam are based on the broad-crested weir equation:

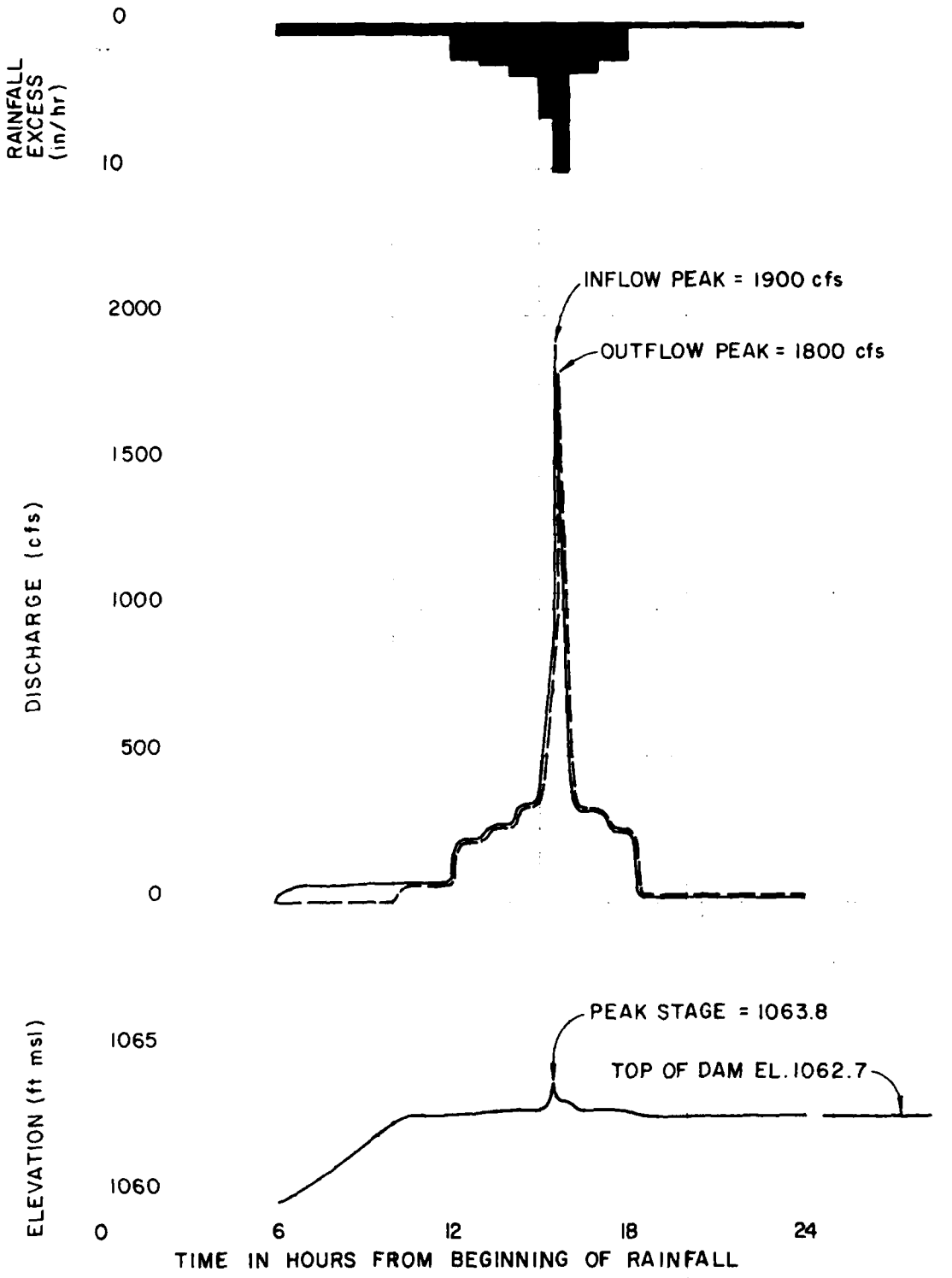
$Q = CLH^{1.5}$ (C = 2.63, L = 597 feet, H = head on weir)

3. The elevation-storage relationship above normal pool elevation was constructed by planimetering the area enclosed within each contour above normal pool. The storage between two elevations was computed by multiplying the average of the areas at the two elevations by the elevation difference. The summation of these increments below a given elevation is the storage below that level.

4. Floods are routed through the spillway using HEC-1, modified Puls to determine the capability of the spillway. Inflow and outflow hydrographs are shown on Plates A-1, A-2, A-3, and A-4.

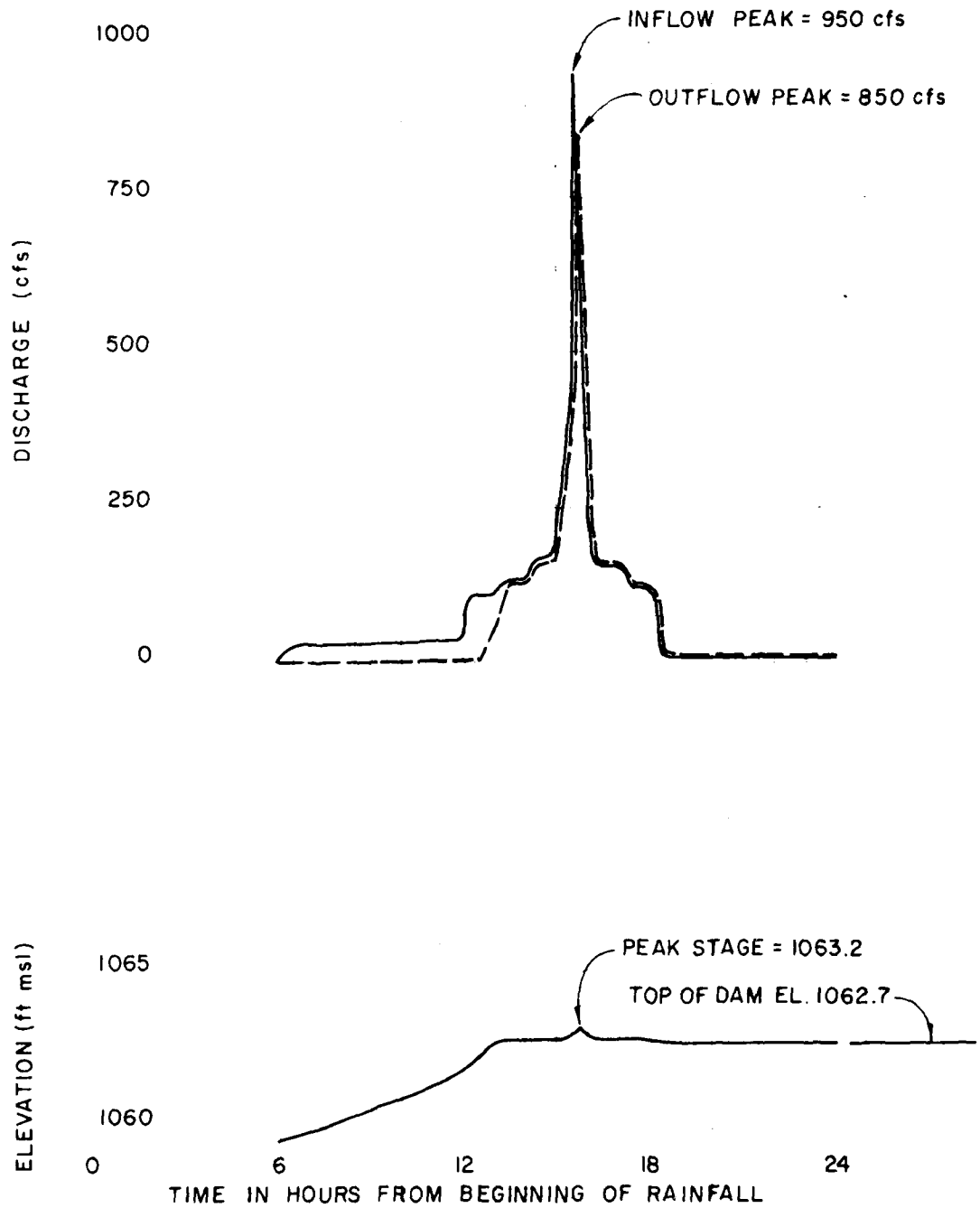
(1) U.S. Army Corps of Engineers, Hydrologic Engineering Center, Flood Hydrograph Package (HEC-1), Dam Safety Version, July 1978, Davis, California.

(2) U.S. Department of the Interior, Bureau of Reclamation, Design of Small Dams, 1974, Washington, D.C.



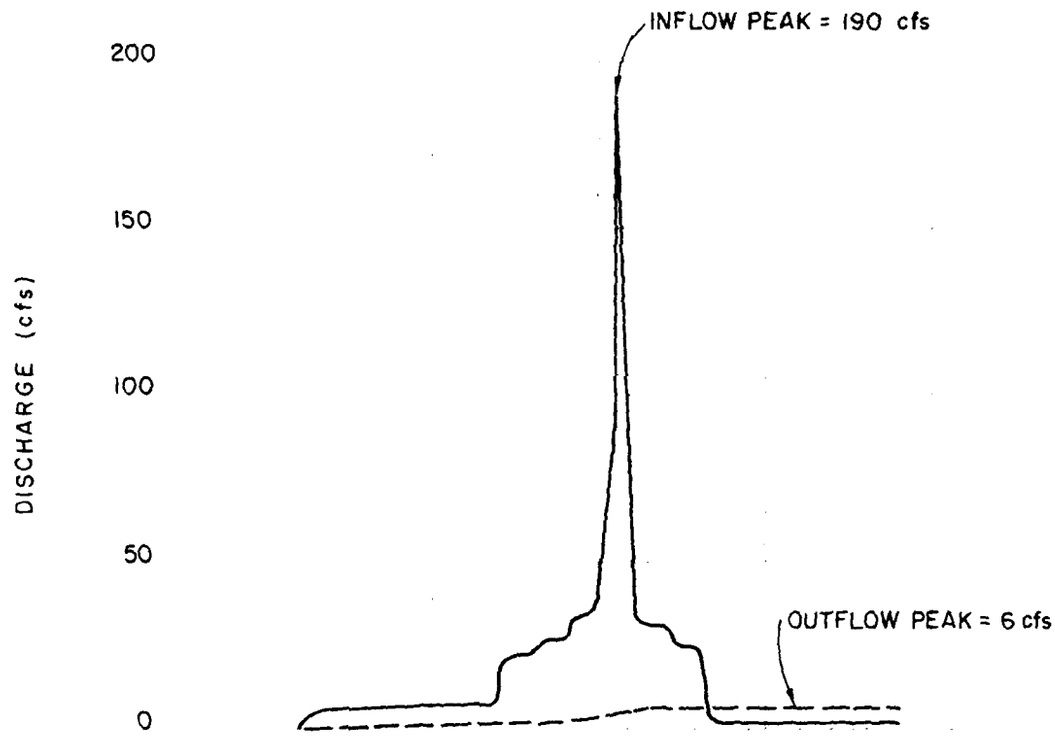
SCOTTY'S LAKE
PROBABLE MAXIMUM FLOOD
HYETOGRAPH, HYDROGRAPHS AND STAGE - TIME CURVE

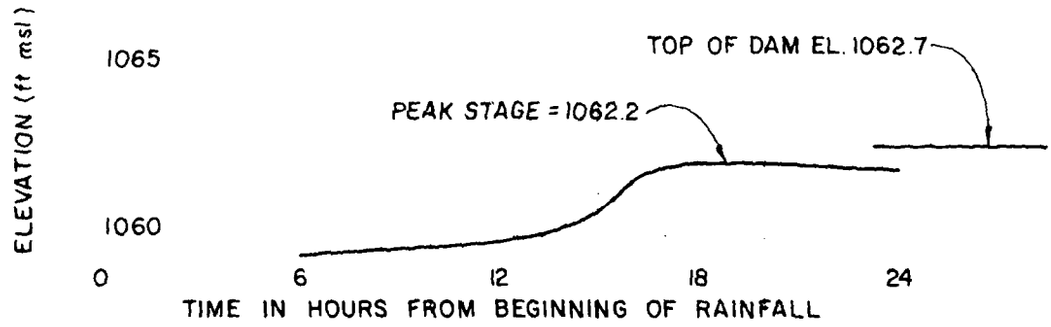
PLATE A-1



SCOTTY'S LAKE
50% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS AND STAGE - TIME CURVE

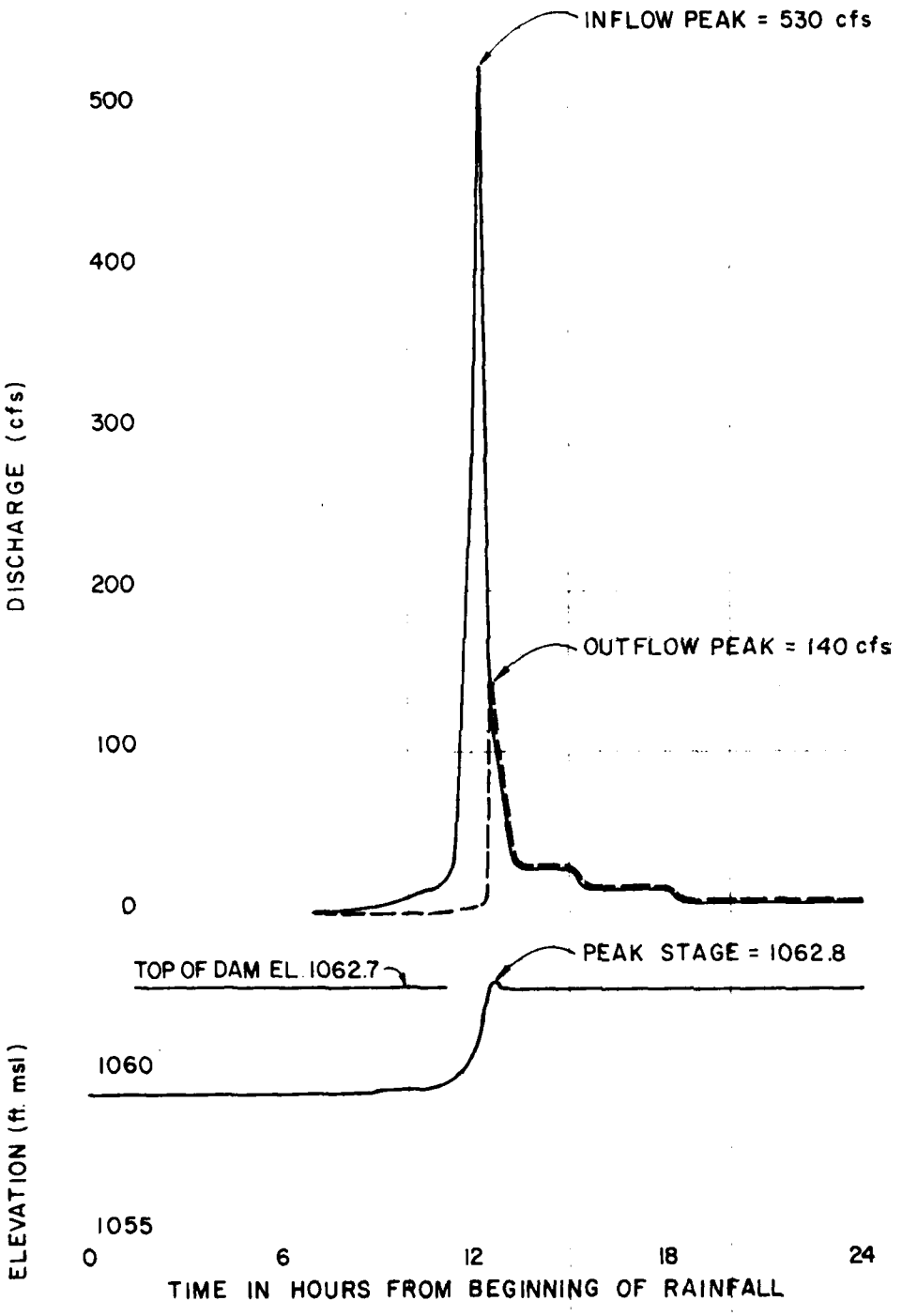
PLATE A-2





SCOTTY'S LAKE
10% PROBABLE MAXIMUM FLOOD
HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-3



SCOTTY'S LAKE
100-YEAR FLOOD
HYDROGRAPHS AND STAGE - TIME CURVE

PLATE A-4

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********
    1              A1MISSOURI DAM INSPECTION PROGRAM
    2              A2ST. LOUIS DISTRICT US ARMY CORPS OF ENGR
    3              A3SCOTTY'S LAKE NO.10271
    4              B    288       0       5       0       0       0       0       0       0       0
    5              B1     5
    6              J      1       9       1
    7              J1   .10     .20     .25     .30     .35     .40     .45      .5      1.
    8              K      0       1                                       3       1
    9              K1   24 HR PMF INFLOW
   10              M      1       2     .14                               1
   11              P              24.2     101     120     130
   12              T                                                       -1     -91
   13              W2             .10
   14              X                      1
   15              K      1       2                                       1
   16              K1   ROUTE THROUGH DROP INLET
   17              Y                                      1       1
   18              Y1     1                                               -1      -1
   19              Y41059.4   1059.9  1062.7  1063.7  1064.7   1067.
   20              YS     0     1.11    7.44    1579.   4450.   14011.
   21              SS     0     71.7   201.7
   22              SE1059.4   1070.   1080.
   23              SS1059.4
   24              SD1062.7
   25              K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS								
				RATIO 1 .10	RATIO 2 .20	RATIO 3 .25	RATIO 4 .30	RATIO 5 .35	RATIO 6 .40	RATIO 7 .45	RATIO 8 .50	RATIO 9 1.00
HYDROGRAPH AT	1	.14	1	188.	375.	469.	563.	656.	750.	844.	938.	1876.
	(	.36)	(	5.31)(	10.62)(	13.28)(	15.93)(	18.59)(	21.25)(	23.90)(	26.56)(	53.11)
ROUTED TO	2	.14	1	6.	327.	431.	518.	604.	691.	777.	863.	1776.
	(	.36)	(	.18)(	9.26)(	12.21)(	14.67)(	17.11)(	19.56)(	22.00)(	24.45)(	50.30)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1059.40	1059.40	1062.70
STORAGE	0.	0.	22.
OUTFLOW	0.	0.	7.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.10	1062.25	0.00	19.	6.	0.00	18.25	0.00
.20	1062.90	.20	24.	327.	2.83	15.67	0.00
.25	1062.97	.27	24.	431.	3.50	15.67	0.00
.30	1063.02	.32	25.	518.	4.17	15.67	0.00
.35	1063.08	.38	25.	604.	10.08	15.67	0.00
.40	1063.13	.43	25.	691.	10.50	15.67	0.00
.45	1063.19	.49	26.	777.	10.83	15.67	0.00
.50	1063.24	.54	26.	863.	11.08	15.67	0.00
1.00	1063.77	1.07	30.	1776.	13.67	15.67	0.00

END

DATE
FILMED

11-81

DTIC